

GLYNN HULLEY

curriculum vitae

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SHORT BIOGRAPHY

Dr. Glynn Hulley is a physicist in the Earth Surface Science Group in the Earth Science Section at the Jet Propulsion Laboratory. His research is focused on improving our understanding of Earth surface properties, ecosystem and atmospheric processes.

Glynn's research interests are focused on the remote sensing of Earth surface properties using thermal infrared spectroscopy. He is a member of several NASA satellite instrument teams including AIRS, ASTER, MODIS, NPP, and Landsat. A key aspect of Glynn's research is the development of new techniques to retrieve surface temperature and spectral emissivity information from thermal remotely sensed data. Algorithms and science products developed by Glynn are widely used by researchers and have been incorporated into commercial packages by NASA.

Glynn has developed an ASTER Global Emissivity Database (ASTER GED, <http://emissivity.jpl.nasa.gov/aster-ged>) based on millions of ASTER observations of surface emissivity since 2000. ASTER GED is 2,500X more detailed than any previous emissivity products currently produced, and is the most accurate emissivity database currently available for Earth science research. It is currently being used as an absolute reference standard in research conducted by both domestic and foreign research agencies. Glynn is also lead scientist for the surface temperature and emissivity products produced from NASA's MODIS and VIIRS sensors that will produce the most accurate (~1°C) temperature at any point on the globe on 4x daily time-steps.

Glynn is also currently working with colleagues to demonstrate a new airborne hyperspectral thermal imager (HyTES) at JPL, and is also helping to develop algorithms and science objectives for the thermal infrared sensor on the HyspIRI Satellite Mission recommended by the National Research Council (NRC) Decadal Survey for Earth Science. He is currently leading the effort to produce Level-2 thermal infrared products from the the ECOSystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS), which will offer clues about how Earth's water and carbon cycles affect plant growth and how ecosystems adapt to changes in climate by measuring evapotranspiration, or the loss of water from leaves and soil. He is also actively involved in planning activities and collaborating with other scientists at NASA and other agencies, e.g. NOAA and the European Space Agency (ESA).

EDUCATION

- Ph. D.**, Atmospheric Physics, University of Maryland Baltimore County, 2007.
M. Sc., Atmospheric Physics, University of Maryland Baltimore County, 2005.
B. Sc., Computational Physics and Mathematics, Francis Marion University, 2001

EMPLOYMENT HISTORY

Oct 2010 to present	Level-IV Research Scientist , Jet Propulsion Laboratory (JPL) California Institute of Technology, 4800 Oak Grove Dr, Pasadena, CA
Oct 2007 to Sep 2010	Postdoctoral Research Scientist , Jet Propulsion Laboratory (JPL) California Institute of Technology, 4800 Oak Grove Dr, Pasadena, CA
Aug 2003 to May 2005	Graduate Research Assistant , Joint Center for Earth Systems Technology (JCET) University of Maryland Baltimore County (UMBC), Baltimore, MD
Sep 2001 to July 2003	Teaching Assistant , Physics Department, University of Maryland Baltimore County (UMBC), Baltimore, MD
Summer 2001	Visiting scientist , Visiting Student Enrichment Program (VSEP), NASA's Goddard Space Flight Center, Greenbelt, MD

LANGUAGES

Native:	English
Fluent:	Afrikaans
Basic:	Xhosa

SKILLS

Generic	Advanced user of MS Office applications. Comfortable on Windows, Mac and Linux/Unix platforms.
Programming	Matlab, Python, Fortran, R, Maple, Mathematica, C++
Web	Knowledgeable of, and used, many web architectures; proficient in HTML, Plone, and Latex.
Writing	Comfortable and experienced writing in academic, business, technical and informal styles.

PROFESSIONAL BODIES AND MEMBERSHIPS

2012-2016	EarthTemp Network , "to stimulate new international collaboration in measuring and understanding the surface temperatures of Earth" Active member and participant in workshops in Edinburgh, UK (2012) and Reading, UK (2014). http://www.earthtemp.net/
2012-present	GlobTemperature , "a DUE project funded by ESA aiming at distributing Land Surface Temperature products (LST) to the user community" Steering committee member. http://www.globtemperature.info/
2014-present	ILSTE-WG , "The International Land Surface Temperature and Emissivity Working Group (ILSTE-WG) aims to provide advice and recommendations to the wider scientific and user communities on the best practices for retrieval,

validation and exploitation of Land Surface Temperature (LST), Ice Surface Temperature (IST), Lake Surface Water Temperature (LSWT), and Land Surface Emissivity (LSE)."

Steering committee member. <http://ilste-wg.org/>

2015-present	LP DAAC User Working Group , USGS, Sioux Falls, SD. Active member.
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CONFERENCE SUPPORT

April 2016	Session co-convener and co-chair , European Geophysical Union (EGU), 17-22 April, 2016, Vienna, Austria. CL2.02/AS4.10/CR6.6/OS1.22, Taking the temperature of Earth: Variability, trends and applications of observed surface temperature data across all domains of Earth's surface
Dec 2015	Session primary convener and chair , American Geophysical Union (AGU), 14-18 December, 2015, San Francisco, CA. Taking the temperature of Earth: Taking the temperature of the Earth: Long term trends and variability across all domains of Earth's surface
Dec 2014	Session primary convener and chair , American Geophysical Union (AGU), 15-19 December, 2015, San Francisco, CA. Taking the temperature of Earth: Taking the temperature of the Earth: Challenges and applications across all Earth surface domains
Dec 2013	Session primary convener and chair , American Geophysical Union (AGU), December, 2015, San Francisco, CA. Taking the temperature of Earth: Taking the temperature of the Earth: Challenges and applications across all Earth surface domains

NASA GRANTS WON

The Ecosystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) – NASA EVI, 07/01/14-03/29/20, \$30 mil, **Co-Investigator**

A New MODIS Land Surface Temperature and Spectral Emissivity Product (MOD21) for Earth Science Research, Science of Terra and Aqua - NASA, 08/01/14 - 07/31/17, \$749.5 K, **Principal Investigator**

A Unified VIIRS Land Surface Temperature and Emissivity (LST&E) Product for Earth Science Research and MODIS Continuity, 08/01/14 - 07/31/17, \$788.0 K, **Principal Investigator**

HyspIRI discrimination of plant species and functional types along a strong environmental-temperature gradient, NASA-HyspIRI Preparatory, 10/01/13 - 10/31/16, \$150.0 K, **Co-Investigator**

Estimating, validating and conveying measurement differences between land surface temperature and emissivity products from NASA's EOS sensors, NASA-ESDR, 10/01/10 - 09/30/13, \$1.2 M, **Science Principal Investigator**

Improving the VIIRS Land Surface Temperature Product for use as an Earth System Data Record, NASA-NPP, 10/01/10 - 09/30/13, \$367.1 K, **Science Principal Investigator**

A Unified and Coherent Land Surface Temperature and Emissivity Earth System Data Record (ESDR), NASA-MEaSUREs Program, 01/01/14 - 12/31/19, \$850.0 K, **Science Principal Investigator**

NASA PROJECTS

The Ecosystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) – NASA EVI

A New VIIRS Land Surface Temperature and Emissivity Environmental Data Record (2014 – present)

A MODIS Land Surface Temperature and Spectral Emissivity product (MOD21) for Earth Science Research (2014-present)

A Unified and Coherent Land Surface Temperature and Emissivity Earth System Data Record (ESDR), NASA-MEaSUREs Program (2014-present)

Atmospheric Infrared Sounder (AIRS) Level-2 Land Surface Temperature and Emissivity testing and validation expert (2007-present)

Advanced Thermal Emission and Reflection Radiometer (ASTER) Thermal Infrared research scientist in development of a global emissivity database (ASTER GED) (2007-present)

Hyperspectral Infrared Imager (HyspIRI) thermal infrared algorithm and product development specialist (2007-present)

Hyperspectral Thermal Emission Spectrometer (HyTES) algorithm developer and data analyst (2012-2013)

AWARDS

NASA Early Career Achievement Medal, September 2014

JPL Team Award, for support as co-investigator in winning the ECOSTRESS EVI-2 proposal, September, 2014

JPL Team Award, algorithm development and near-real time processing of data from the second Hyperspectral Thermal Emission Spectrometer

(HyTES) Science campaign, August 2014

JPL Team Award, successful first deployment of the airborne Hyperspectral Thermal Emission Spectrometer (HyTES), August 2012

Top five best reviewer for IEEE Transactions on Geoscience and Remote Sensing Letters (TGRS), 2010

UMBC Class of 2007 Exceptional Graduates

Outstanding Student Paper Award, AGU, Baltimore, MD, 2006

Physics Award for best student, 2001, Francis Marion University

Presidents List of Distinguished Students, 1998 - 2001, Francis Marion University

EXTRACURRICULAR ACTIVITIES

Active participant in a number of sports including tennis, golf, biking, running, and swimming.

Francis Marion University NCAA Tennis Team, 1998 - 2001

- Team captain, 2000 - 2002
- Academic All American, 2000 and 2002
- Loren Mason MVP award for 1999 and 2000 seasons

UMBC Cricket Club, Baltimore MD, 2004 - 2006

- Vice president, 2005
- Team captain, 2006

PUBLICATIONS

2016

1. T. Islam, **G. C. Hulley**, N. Malakar, R. Radocinski, S. Hook (2016), A physics-based algorithm for the simultaneous retrieval of land surface temperature and emissivity from VIIRS thermal infrared data, *IEEE TGARS*, in review
2. Malakar, N.K., and **G. C. Hulley**, (2016), A Water Vapor Scaling Model for Improved Land Surface Temperature and Emissivity Separation of MODIS Thermal Infrared Data, *Remote Sensing of Environment*, 2016, DOI: 10.1016/j.rse.2016.04.023
3. **Hulley, G. C.**, Duren, R. M., Hopkins, F. M., Hook, S. J., Vance, N., Guillevic, P., Johnson, W. R., Eng, B. T., Mihaly, J. M., Jovanovic, V. M., Chazanoff, S. L., Staniszewski, Z. K., Kuai, L., Worden, J., Frankenberg, C., Rivera, G., Aubrey, A. D., Miller, C. E., Malakar, N. K., Sánchez Tomás, J. M., and Holmes, K. T.: High spatial resolution imaging of methane and other trace gases with the airborne Hyperspectral Thermal Emission Spectrometer (HyTES), *Atmos. Meas. Tech. Discuss.*, doi:10.5194/amt-2016-8, in press, 2016.

4. Kuai, L., Worden, J. R., Li, K., **Hulley, G. C.**, Hopkins, F. M., Miller, C. E., Hook, S. J., Duren, R. M., and Aubrey, A. D.: Characterization of anthropogenic methane plumes with the Hyperspectral Thermal Emission Spectrometer (HyTES): a retrieval method and error analysis, *Atmos. Meas. Tech. Discuss.*, doi:10.5194/amt-2015-402, in review, 2016.

2015

5. **Hulley, G.**, Hook S.J, Abbott, E., Malakar, N., Islam, T., Abrams, M., (2015), The ASTER Global Emissivity Database (ASTER GED): Mapping Earth's emissivity at 100 meter spatial resolution, *Geophysical Research Letters*, 42, doi:10.1002/2015GL065564.
6. Hochberg, E. J., Roberts, D.A., Dennison, P.E, **Hulley, G.C.**, (2015), Special issue on the Hyperspectral Infrared Imager (HyspIRI): Emerging Science in terrestrial and aquatic ecology, radiation balance and hazards, *Rem. Sens. Environ.*, 167 (1-5)
7. Abrams, M., Tsu, H., **Hulley, G.**, Iwao, K., Pieri, D., Cudahy, T. (2015), The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) after fifteen years: Review of global products, *Int. Journal of Applied Earth Observation and Geoinformation*, 38 (202-301).
8. Grigsby, S.P., **Hulley, G.C.**, Roberts D.A., Scheele, C., Ustin S.L, Alsina, M.M (2015), Remote Sensing of Environment, 167, 53-63.
9. Roberts, D.A., Dennison, P.E., Roth K.L., Dudley, K., and **G. Hulley** (2015), Relationships between dominant plant species, fractional cover and Land Surface Temperature in a Mediterranean ecosystem, *Remote Sensing of Environment*, 167, 152-167.

2014

10. Kahn, B. H., Kahn, B. H., F. W. Irion, V. T. Dang, E. M. Manning, S. L. Nasiri, C. M. Naud, J. Blaisdell, M. M. Schreier, Q. Yue, K. W. Bowman, E. J. Fetzer, **G. C. Hulley**, K. N. Liou, D. Lubin, S. C. Ou, J. Susskind, Y. Takano, B. Tian, and J. Worden (2014), The Atmospheric Infrared Sounder Version 6 cloud products, *Atmos. Chem. Phys.*, 14, 399-426.
11. Guillevic, P. C., Biard, J., **Hulley, G. C.**, Privette, J. L., Hook, S. J., Olioso, A., Götsche, F.-M., Radocinski, R., Román, M. O., Yu, Y., and Csiszar I. (2014). Validation of Land Surface Temperature products derived from the Visible Infrared Imager Radiometer Suite (VIIRS) using ground-based and heritage satellite measurements. *Remote Sensing of Environment*, 154 (2014) 19–37, doi: 10.1016/j.rse.2014.08.013.
12. Ermida, S.L, Trigo, I. F., DaCamara, C.C, Gottsche, F.M, Olesen, F.S, **Hulley, G.C.**, (2014), Validation of remotely sensed surface temperature over an oak woodland landscape - The problem of viewing and illumination geometries, *Rem. Sens. Environ.*, 148 (16-27)
13. Jimenez-Munoz, J.C., Sobrino, J.A., Mattar, C., **Hulley, G.**, Gottsche, F., (2014), Temperature and Emissivity Separation from MSG/SEVIRI Data, *IEEE. Trans.*

Geos. Rem. Sens., DOI: 10.1109/TGRS.2013.2293791

14. **Hulley, G.**, S. Veraverbeke, S. Hook, (2014), Thermal-based techniques for land cover change detection using a new dynamic MODIS multispectral emissivity product (MOD21), *Rem. Sens. Environ.*, 140, p755-765

2013

15. Merchant, C. J., Matthiesen, S., Rayner, N. A., Remedios, J. J., Jones, P. D., Olesen, F., Trewin, B., Thorne, P. W., Auchmann, R., Corlett, G. K., Guillevic, P. C., and **Hulley, G. C.**: The surface temperatures of Earth: steps towards integrated understanding of variability and change, *Geosci. Instrum. Method. Data Syst.*, 2, 305-321, doi:10.5194/gi-2-305-2013, 2013.
16. Guillevic, P.C., Bork-Unkelbach, A., Gottsche, F.M., **Hulley, G.**, Gastellu-Etchegorry, J.P., Olesen, F.S., & Privette, J.L. (2013). Directional Viewing Effects on Satellite Land Surface Temperature Products Over Sparse Vegetation Canopies-A Multisensor Analysis. *IEEE Geoscience and Remote Sensing Letters*, 10, 1464-1468

2012

17. **Hulley, G. C.**, T. Hughes, and S. J. Hook (2012), Quantifying Uncertainties in Land Surface Temperature (LST) and Emissivity Retrievals from ASTER and MODIS Thermal Infrared Data, *J. Geophys. Res. Lett.*, 117, D23113, doi:10.1029/2012JD018506.
18. **Hulley, G. C.**, and S. J. Hook (2012), A radiance-based method for estimating uncertainties in the Atmospheric Infrared Sounder (AIRS) land surface temperature product, *J. Geophys. Res. Lett.*, 117, D20117, doi:10.1029/2012JD019102.
19. Götsche, F. M., and **G. C. Hulley**, (2012), Validation of six satellite-retrieved land surface emissivity products over two land cover types in a hyper-arid region, *Rem. Sens. Environ.*, 124, 149-158.
20. Veraverbeke, S., S. Hook and **G. Hulley**, (2012), An alternative spectral index for rapid fire severity assessments, *Rem. Sens. Environ.*, 123, 72-80.

2011

21. **Hulley, G.C.**, S.J. Hook & P. Schneider, (2011), Optimized split-window coefficients for deriving surface temperatures from inland water bodies, *Remote Sensing of Environment*, 115, 3758-3769
22. Gillespie, A.R., E.A. Abbott, L. Gilson, **G. Hulley**, J.C. Jimenez-Munoz, and J.A. Sobrino, (2011), Residual errors in ASTER temperature and emissivity standard products AST08 and AST05, *Remote Sensing of Environment*, doi:10.1016/j.rse.2011.09.007
23. Roberts, D.A., D. A. Quattrochi, **G. C. Hulley**, S.J. Hook, and R.O. Green, (2011), Synergies between VSWIR and TIR data for the urban environment: An evaluation of the potential for the Hyperspectral Infrared Imager (HyspIRI) Decadal Survey mission, *Remote Sensing of Environment*.

2010

24. **Hulley, G. C.**, and S. J. Hook, (2010), Generating Consistent Land Surface Temperature and Emissivity Products Between ASTER and MODIS Data for Earth Science Research, *IEEE Trans. Geos. Rem. Sens.*, DOI: 10.1109/TGRS.2010.2063034.
25. **Hulley, G. C.**, S. J. Hook, and A. M. Baldridge, (2010), Investigating the Effects of Soil Moisture on Thermal Infrared Land Surface Temperature and Emissivity Using Satellite Retrievals and Laboratory Measurements, *Remote Sensing of Environment*, 114, 1480-1493.

2009

26. Schneider, P., S. J. Hook, R. G. Radocinski, G. K. Corlett, **G. C. Hulley**, S. G. Schladow, and T. E. Steissberg, (2009), Satellite observations indicate rapid warming trend for lakes in California and Nevada, *Geophys. Res. Lett.*, 36, L22402, doi:10.1029/2009GL040846
27. **Hulley, G. C.**, S. J. Hook, E. Manning, S-Y Lee, and E. Fetzer, (2009), Validation of the Atmospheric Infrared Sounder (AIRS) Version 5 Land Surface Emissivity Product over the Namib and Kalahari Deserts, *Journal of Geophys. Res. Atmos.*, 114, D19104.
28. **Hulley, G. C.**, S. J. Hook, and A. M. Baldridge, (2009), Validation of the North American ASTER Land Surface Emissivity Database (NAALSED) version 2.0 using pseudo-invariant sand dune sites, *Remote Sens. Environ.*, 113, 2224-2233
29. **Hulley, G. C.**, and S. J. Hook (2009), The North American ASTER Land Surface Emissivity Database (NAALSED) Version 2.0, *Remote Sens. Environ.*, 113, 1967-1975
30. **Hulley, G. C.**, and S. J. Hook (2009), Intercomparison of versions 4, 4.1 and 5 of the MODIS Land Surface Temperature and Emissivity Products and validation with laboratory measurements of sand samples from the Namib desert, Namibia, *Remote Sens. Environ.*, 113, 1313-1318

2008

31. **Hulley, G.**, S. J. Hook, (2008), ASTER Land Surface Emissivity Database of California and Nevada, *Geophys. Res. Lett.*, 35, L13401, doi:10.1029/2008GL034507
32. **Hulley, G.**, S. J. Hook, (2008), A New Methodology for Cloud Detection and Classification with Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Data, *Geophys. Res. Lett.*, 35, L16812, doi:10.1029/2008GL034664

2007

33. **Hulley, G.**, E. C. Pavlis, (2007), A global study on the effects of atmospheric refractivity gradients on the analysis of Satellite Laser Ranging (SLR) data. *J. Geophys. Res.*, 112, B06417, doi:10.1029/2006JB004834

RECENT CONFERENCE PRESENTATIONS

Hulley, G. C., T. Islam, N. Malakar, (2015), MODIS and VIIRS Land Surface Temperature and Emissivity: A Consistent and High Quality Continuity Data Record, American Geophysical Union, San Francisco, CA, December 2015

Hulley, G.C., (2015), ECOSTRESS Level-Products, Processing, Simulated Data, Cal/Val, 2015 HyspIRI Science and Applications Workshop, Pasadena, CA, 13-15 October 2015.

Hulley, G. C., N. Malakar, T. Islam, S. Hook, P. Guillevic (2015), Land Surface Temperature and Emissivity (LST&E) products for MODIS and VIIRS Continuity, MODIS/VIIRS Science Team meeting, Silver Spring, MD, 19-22 May, 2015

Hulley, G.C., S.J. Hook, R. Duren, A. Aubrey, P. Guillevic, (2014), Detection and spatial mapping of anthropogenic methane plumes with the Hyperspectral Thermal Emission Spectrometer (HyTES), American Geophysical Union, San Francisco, CA, December 2014

Hulley, G.C., (2014), ECOSTRESS L1/L2 Algorithm and Product Development, 2014 HyspIRI Science and Applications Workshop, Pasadena, CA, October 2014.

Hulley, G.C., S.J. Hook, P. Guillevic, (2014), A Unified MODIS Land Surface Temperature Earth System Data Record, RAQRS 2014, Valencia, Spain.

Hulley, G.C., S.J. Hook, T.J. Hughes, (2012), A Unified MODIS Land Surface Temperature Earth System Data Record, American Geophysical Union, Fall Meeting, San Francisco, CA, 3-7 December, 2012

Hulley, G.C, T.J. Hughes, S.J. Hook, (2012), A Unified MODIS Land Surface Temperature Earth System Data Record, EarthTemp LST Workshop, Edinburgh, Scotland, 25-27 June, 2012

SCIENCE PRODUCT DOCUMENTS AND DELIVERABLES

ECOSTRESS

Hulley, G. C., Hook, S. J., (2015), ECOSTRESS Level-2 Land Surface Temperature and Emissivity Algorithm Theoretical Basis Document (ATBD), JPL, Jet Propulsion Laboratory, California Institute of Technology, Feb 2015.

Hulley, G. C., Hook, S. J., (2016), ECOSTRESS Level-2 Cloud Detection Algorithm Theoretical Basis Document (ATBD), JPL, Jet Propulsion Laboratory, California Institute of Technology, Feb 2016.

Hulley, G. C., Hook, S. J., (2016), ECOSTRESS Level-2 Product Specification Document (ASD), JPL, Jet Propulsion Laboratory, California Institute of Technology, Feb 2016.

Hulley, G. C., Hook, S. J., (2016), ECOSTRESS Level-2 PGE-PCS Interface Memo, JPL, Jet Propulsion Laboratory, California Institute of Technology, May 2016.

HyTES

Hulley, G. C., S. Hook, W. Johnson, P. Guillevic, N. Malakar, (2016), Hyperspectral Thermal Emission Spectrometer (HyTES) Level-2 Land Surface Temperature and Emissivity Algorithm Theoretical Basis Document, JPL Publication XX, Jet Propulsion Laboratory, California Institute of Technology, May 2016.

Hulley, G. C., N. Vance, L. Kuai, S. Hook (2016), Hyperspectral Thermal Emission Spectrometer (HyTES) L3 Data Product Guide, JPL Publication XX, Jet Propulsion Laboratory, California Institute of Technology, May 2016.

HySPIRI

Hulley, G. C., and S. J. Hook, (2012), HySpIPI Cloud Mask Detection Algorithm Theoretical Basis Document, JPL Publication 12-15, Jet Propulsion Laboratory, California Institute of Technology, Oct 2012.

http://hyspiri.jpl.nasa.gov/downloads/Algorithm_Theoretical_Basis/HySpIPI_CloudMask_v0-5_121023_pmb_gchv1.pdf

Hulley, G. C., and S. J. Hook, (2011), HySpIPI Level-2 Thermal Infrared (TIR) Surface Radiance Algorithm Theoretical Basis Document, JPL Publication 11-1, Jet Propulsion Laboratory, California Institute of Technology, April 2011.

http://hyspiri.jpl.nasa.gov/downloads/Algorithm_Theoretical_Basis/HySpIPI_L2_Surface_Radiance_JPL_Pub_11-1.pdf

Hulley, G. C., and S. J. Hook, (2011), HySpIPI Level-2 Thermal Infrared (TIR) Land Surface Temperature and Emissivity Algorithm Theoretical Basis Document, JPL Publication 11-5, Jet Propulsion Laboratory, California Institute of Technology, May 2011.

http://hyspiri.jpl.nasa.gov/downloads/Algorithm_Theoretical_Basis/HySpIPI_L2_Surface_Temperature_Emissivity_JPL_Pub_11-5_10102011.pdf

Ramsey, M. C., Realmuto, V. J., **Hulley, G. C.**, and S. J. Hook, (2012), HySpIPI Thermal Infrared (TIR) Band Study Report, JPL Publication 12-16, Jet Propulsion Laboratory, California Institute of Technology, Oct 2012.

http://hyspiri.jpl.nasa.gov/downloads/reports_whitepapers/HySpIPI_TIR_Band_Report_gchv1_VJRv1_pmbv1_MSrv2_1.pdf

MODIS

Hulley, G. C., N. Malakar, S. J. Hook, and T. Hughes (2012), MODIS MOD21 Land Surface Temperature and Emissivity Algorithm Theoretical Basis Document, JPL Publication 12-17, Jet Propulsion Laboratory, California Institute of Technology, Aug 2012.

Hulley, G. C., R. Freepartner, N. Malakar, S. Sarkar, (2016), MODIS MOD21 Land

Surface Temperature and Emissivity Users Guide Collection 6, Jet Propulsion Laboratory, California Institute of Technology, May 2016.

VIIRS

Hulley, G. C., T. Islam, N. Malakar, (2016), VIIRS Land Surface Temperature and Emissivity Algorithm Theoretical Basis Document, Jet Propulsion Laboratory, California Institute of Technology, Feb 2016.

Hulley, G. C., R. Freepartner, T. Islam, (2016), VIIRS Land Surface Temperature and Emissivity Users Guide, Jet Propulsion Laboratory, California Institute of Technology, June 2016.

BOOK CHAPTERS

Abrams, M., Vasertling, M., Hook, S., Eckehard, L., Arvidson, T., Sobrino, J., **Hulley, G.**, Merchant, C., Wooster, M., Lombardo, V., Buongiorno, F., Frey, C., Heldens, W., A. Baldridge, (2013), A Water Vapor Scaling (WVS) method for improving atmospheric correction of Thermal Infrared (TIR) data, (Chapter 8), In C. Kuenzer, S. Dech, P. Kock (eds.), *Thermal Infrared Remote Sensing: Sensors, Methods, Applications*, Springer Verlag.

Abrams, M., Vasertling, M., Hook, S., Eckehard, L., Arvidson, T., Sobrino, J., **Hulley, G.**, Merchant, C., Wooster, M., Lombardo, V., Buongiorno, F., Frey, C., Heldens, W., A. Baldridge, (2013), Validation of Thermal Infrared (TIR) emissivity spectra using pseudo-invariant sand dune sites, (Chapter 19), In C. Kuenzer, S. Dech, P. Kock (eds.), *Thermal Infrared Remote Sensing: Sensors, Methods, Applications*, Springer Verlag.